BOND

Breeding Operations
Network for Development

excellenceinbreeding.org/BOND

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Agenda

- **Special guest intro –** Jan Debaene
- **BOND concept –** Gustavo Teixeira
- **Breeding Operations at IITA – Current Scenario and opportunities;** Alick Mulenga, head of breeding operations at IITA
- **Bayer: Seed Production and pipeline delivery**; Gawie Groenewald (BAYER)
- **Q&A**

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Jan Debaene, EiB Deputy Director

9th June, 2021

EiB Purpose

To increase impact of CGIAR and NARS breeding to contribute to achieving the goal of world without hunger or malnutrition by 2030 and to reduce poverty.

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The 6 funders' requests

1. Align breeding pipelines with market segments, develop pipeline investment cases, product profiles, etc.
2. Incentivize management and staff to deliver higher genetic gain.
3. Develop strategic plans for varietal turnover.
4. Quantitatively optimize pipelines to increase genetic gain.
5. Implement shared services.
6. Build NARS breeding networks and capacity.

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Vision for CGIAR breeding

That CGIAR-NARS breeding networks generate rates of genetic gain ≥1.5% p.a. and that the average area weighted age of varieties in farmers' fields is <10 years

Detailed vision for CGIAR breeding:

https://excellenceinbreeding.org/sites/default/files/u107/EiB%20Vision%20for%20CGIAR%20Breeding.pdf

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The focus of breeding operations

1. Accuracy – site selection, management, mechanization, consistency and quality
2. Throughput – number of quality data points, and speed / turnaround time
3. Cost per operation or data point – first determine the costs, then using continuous improvement principles, drive down the cost without sacrificing quality

How does this drive genetic gain?

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The role of operations in context of genetic gains

High quality phenotypic data is cornerstone of any breeding program.

$$\Delta G_{year} = \frac{\mathrm{i}\ r_{AI}\ \sigma_A}{L}$$

Drivers of genetic gain:

- **Accuracy**
- **Breeding cycle time**: Time taken to develop a cohort of new lines and test sufficiently to select best for recycling as a parent
- **Selection intensity** (size of program / number of parents selected)
- Genetic diversity

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Accuracy

There are a number of ways to increase accuracy:

- Reducing sources of error and unwanted variation (plotmanship, consistency, digital data capture and QA/QC)
- Identification of errors and misses (ex.: unsuccessful crosses or contamination): apply continuous improvement principles
- Increase representativeness of TPE's
  - Predictive ability of selection environment for target population of environments → Managed environments
  - More environments, especially in early generations.
- Increased number of plots over more locations – reducing **costs** enables more data points → increased accuracy

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Breeding cycle time

Primarily depends on three factors:

- Line development time; time from cross to testing
  - **Throughput**. This is purely an operational and logistics challenge.
- Accurate data enabling parents to be identified earlier
  - **Accuracy** is determined by operations
- All traits on product profile tested early in pipeline
  - **Throughput and cost**. This is the intersection of throughput, cost and logistics; all determined by operations

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Selection intensity

Is influenced by two factors:

1. Number of lines tested
    - This is a function of **throughput and cost** which are operational issues. High throughput and low cost per datapoint allow more lines to be tested.

2. Number of parents selected
    - Breeders can only reduce the number of parents selected if they are making selections based on highly **accurate** data

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Operations are the cornerstone of genetic gain

By optimizing accuracy, throughput and cost you enable breeding teams to significantly increase rates of genetic gain.

Simulations with CGIAR programs have shown that increased accuracy and throughput will enable breeders to shorten breeding cycle times and improve selection of parents that will result in a up to a 4 fold increase in genetic gain!

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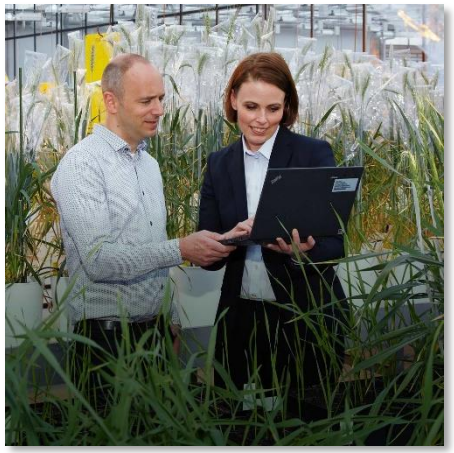
Thank you!

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Why are you here?

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What is the vision?

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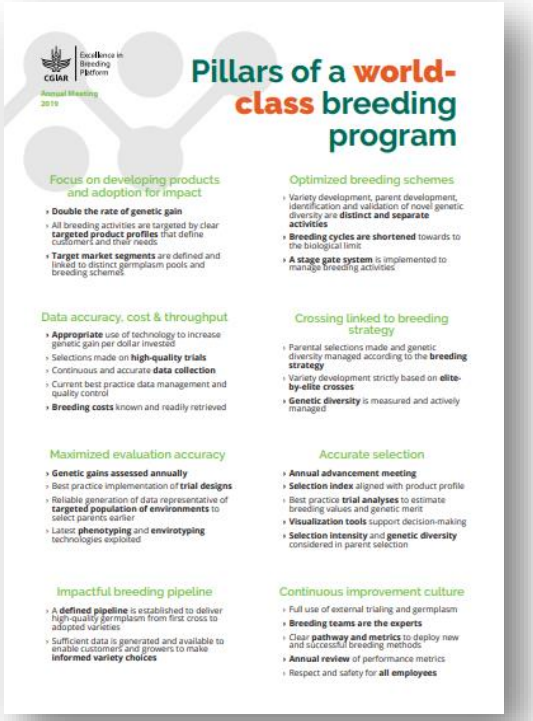
“…breeding programs have the most effective and cost efficient phenotypic process, from field preparation to data collection. With a strong culture of delivery of quality data through continuous improvement. Providing respect and safety for all employees”.



https://excellenceinbreeding.org/eib-annual-meeting/day-1

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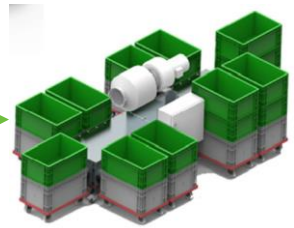
What does it mean?

What does it mean?

Good field (plotmanship) → good agronomic practices (field prep., pest control, etc..) →

Effective and cost efficient process → Mechanization, automation, data collection, access to service… →



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What does it mean?

Continuous Improvement → Everybody everyday →

before

after

Health, Safety and environment → Staff morale, Leading by example, Sustainability →

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What is the current status?

Breeding operations assessment

1. **Agronomic practices**
2. **Seed processing**
3. **Planting and harvesting**
4. **Phenotyping**
5. **Continuous improvement**

25 research stations

National Programs

CGIAR

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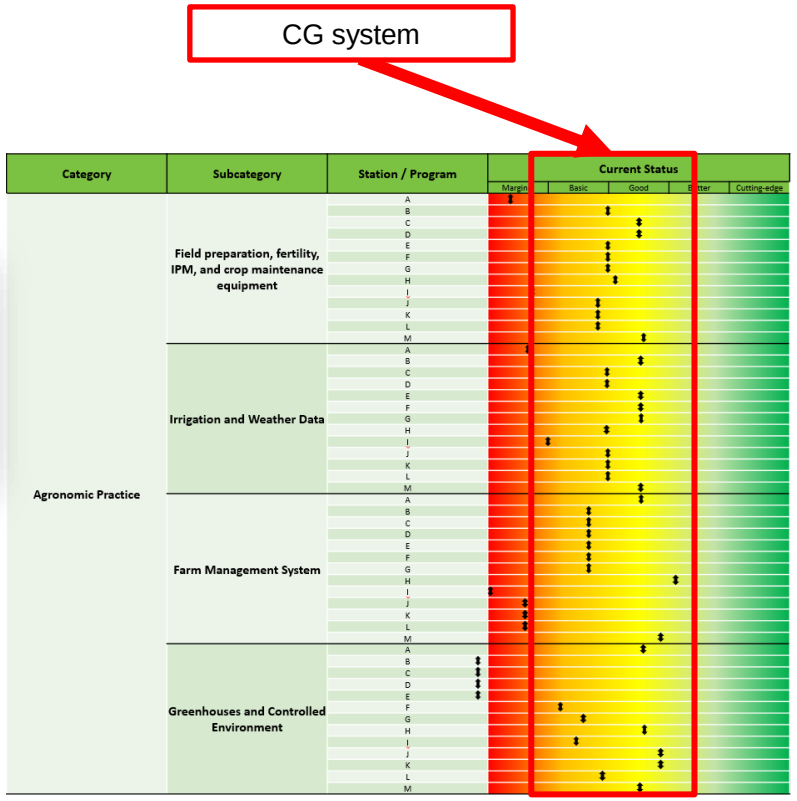
Ranking

Stations visited received a report ranking the current status of each sub-category ranging from Marginal to Cutting-edge.

The table on the right illustrates the current status of agronomic practices in Breeding Operations across CGIAR centers.



Current status of agronomic practices across CGIAR centers

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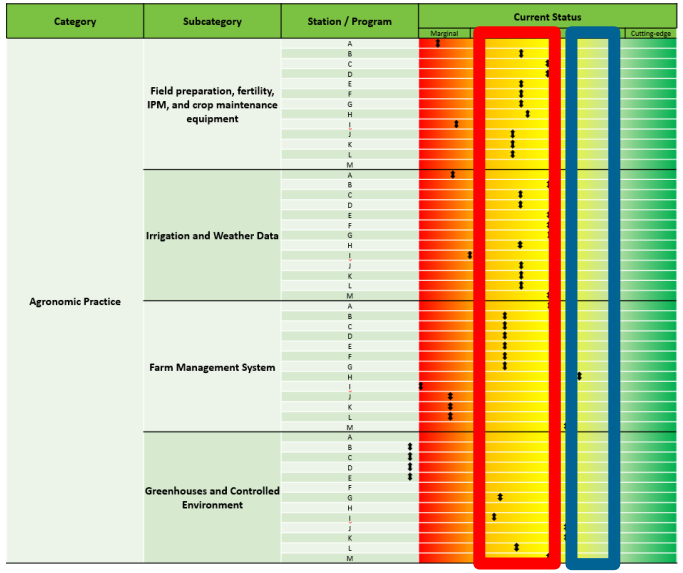
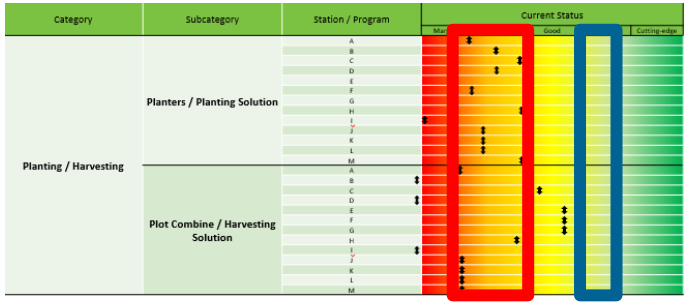
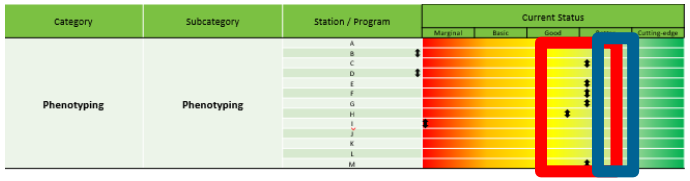


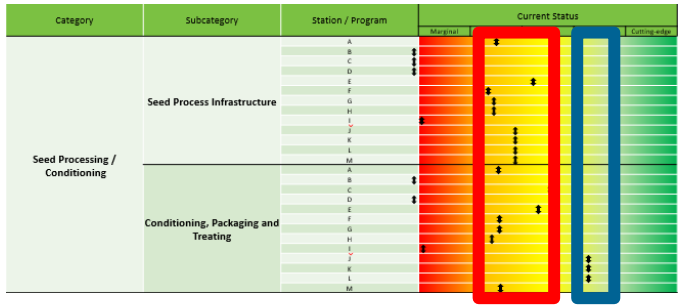
Agronomic Practices



Planting and harvesting



Phenotyping



Seed Processing

Continuous Improvement

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How can we make the transition?

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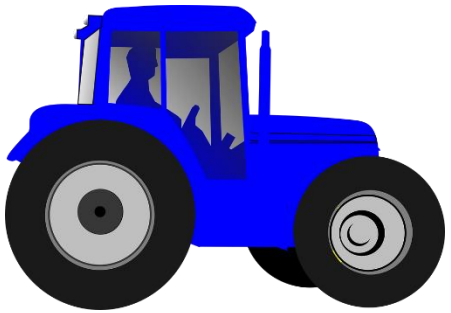
There are many aspects to consider…

Management

Institutional

resources



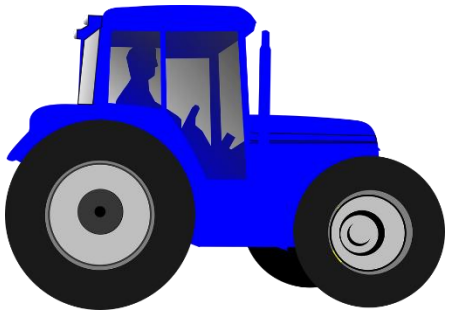
technical

BOND is about...

Management

Institutional

resource



technical

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If we have opportunities to improve….

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There are many good practices to share.....

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What is BOND ?

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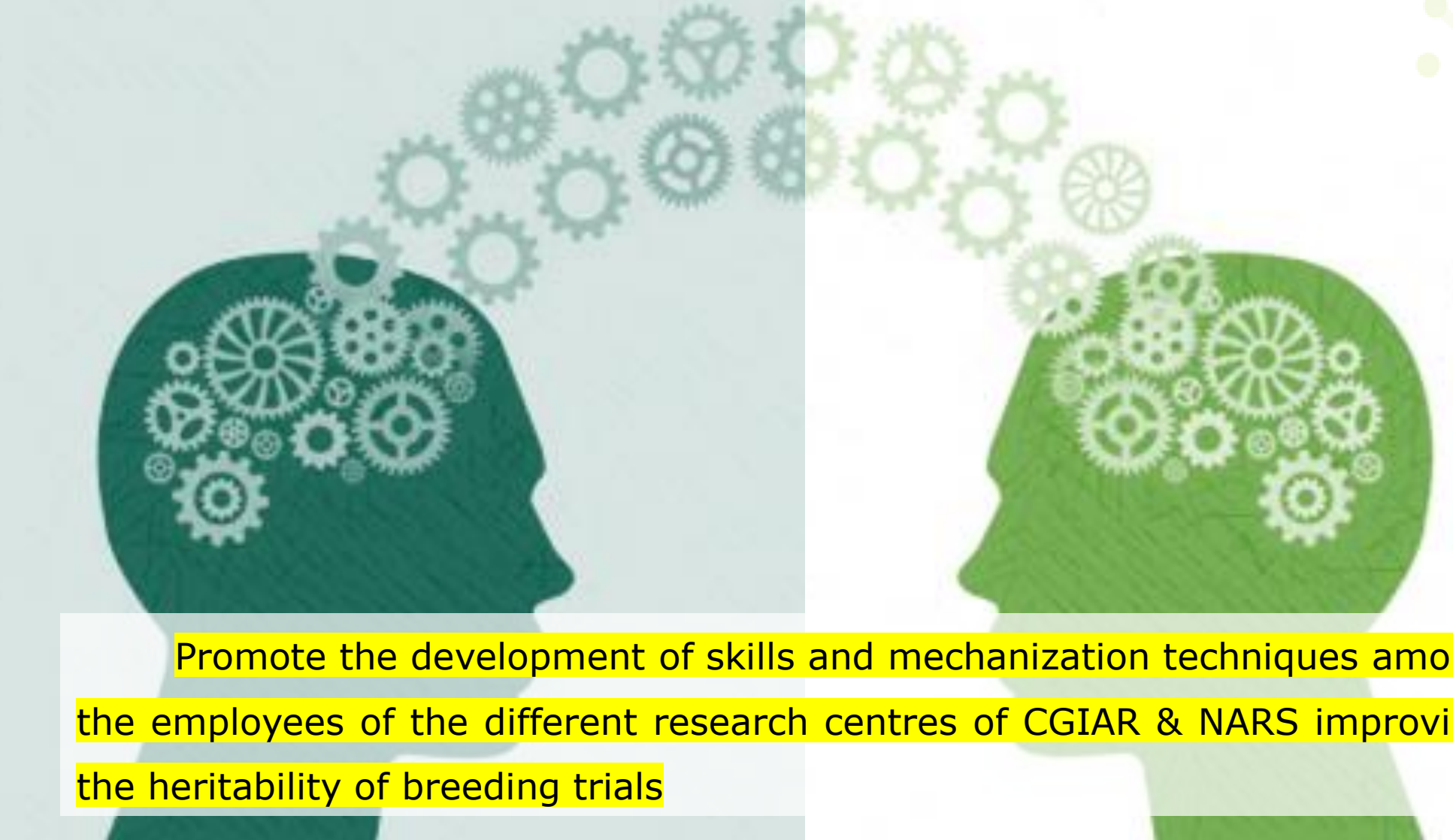

Promote the development of skills and mechanization techniques among the employees of the different research centres of CGIAR & NARS improving the heritability of breeding trials

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How would this program work?

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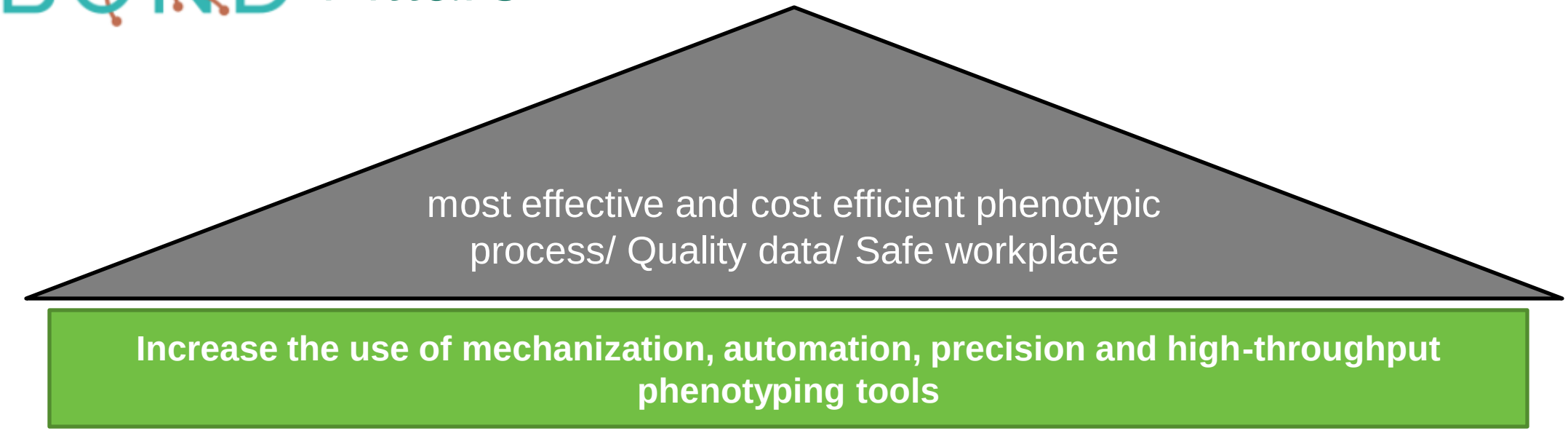
BOND Pillars



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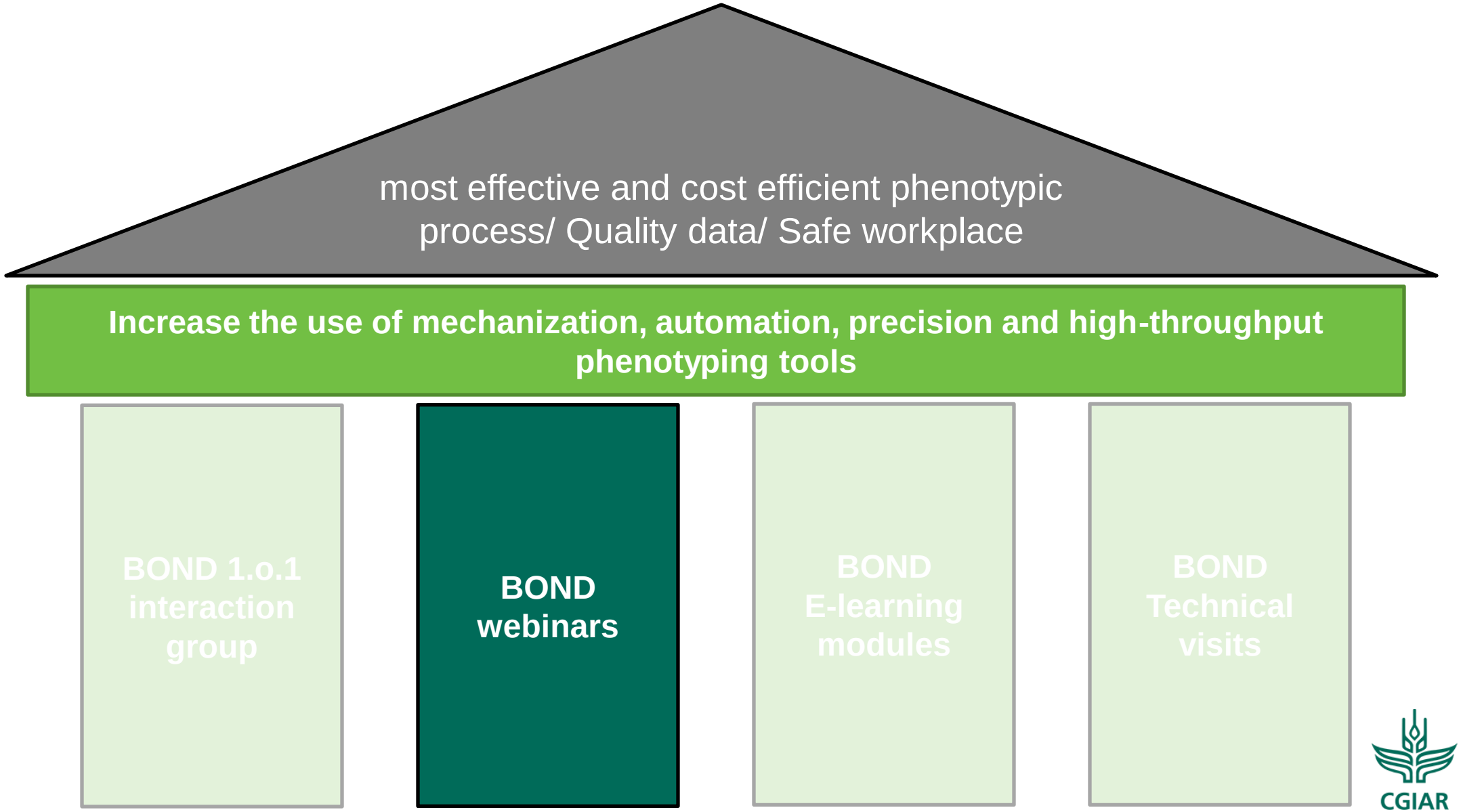
Pillars



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